What is claimed is:

1. A semiconductor nanoparticle complex comprising a semiconductor nanoparticle associated with a cationic polymer capable of enhancing the transport of the semiconductor nanoparticle across a biological membrane.

2. The semiconductor nanoparticle complex of claim 1, wherein the semiconductor nanoparticle is a semiconductor nanocrystal.

3. The semiconductor nanoparticle complex of claim 2, wherein the semiconductor nanocrystal comprises a core is selected from the group consisting of ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, HgS, HgSe, HgTe, MgS, MgSe, MgTe, CaS, CaSe, CaTe, SrS, SrSe, SrTe, BaS, BaSe, BaTe, GaN, GaP, GaAs, GaSb, InN, InP, InAs, InSb, AlAs, AlP, AlSb, AlS, Ge, Si, Pb, PbS, PbSe, an alloy thereof, and a mixture thereof.

4. The semiconductor nanoparticle complex of claim 4, wherein the semiconductor nanocrystal core is CdSe.

5. The semiconductor nanoparticle complex of claim 3, wherein the semiconductor nanocrystal core is surrounded by a semiconductor shell.

6. The semiconductor nanoparticle complex of claim 5, wherein the semiconductor shell comprises a semiconductor material selected from the group consisting of ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, HgS, HgSe, HgTe, MgS, MgSe, MgTe, CaS, CaSe, CaTe, SrS, SrSe, SrTe, BaS, BaSe, BaTe, GaN, GaP, GaAs, GaSb, InN, InP, InAs, InSb, AlAs, AlP, AlSb, AlS, Ge, Si, Pb, PbS, PbSe, an alloy thereof, and a mixture thereof.

7. The semiconductor nanoparticle complex of claim 6, wherein the semiconductor shell is ZnS.

8. The semiconductor nanoparticle complex of claim 1, wherein the cationic polymer is tat peptide from the protein transduction domain of the HIV tat protein.

9. The semiconductor nanoparticle complex of claim 8, wherein the tat peptide comprises the sequence RKKRRQRRR (SEQ ID NO: 1).

10. The semiconductor nanoparticle complex of claim 1, wherein the cationic polymer has from 5 to 25 contiguous Lys and/or Arg residues.

11. The semiconductor nanoparticle complex of claim 1, wherein the biological membrane is a cell membrane.

12. A semiconductor nanocrystal complex comprising a semiconductor nanocrystal associated with a cationic polymer capable of enhancing the transport of the semiconductor nanocrystal across a cell membrane, wherein the semiconductor nanocrystal comprises a core and a shell, wherein the core and the shell are each selected from the group consisting of ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, HgS, HgSe, HgTe, MgS, MgSe, MgTe, CaS, CaSe, CaTe, SrS, SrSe, SrTe, BaS, BaSe, BaTe, GaN, GaP, GaAs, GaSb, InN, InP, InAs, InSb, AlAs, AlP, AlSb, AlS, Ge, Si, Pb, PbS, PbSe, an alloy thereof, and a mixture thereof.

13. The semiconductor nanocrystal complex of claim 12, wherein the core is CdSe and the shell is ZnS.

14. The semiconductor nanocrystal complex of claim 13, wherein the cationic polymer is tat peptide from the protein transduction domain of the HIV tat protein.

15. The semiconductor nanocrystal complex of claim 14, wherein the tat peptide comprises the sequence RKKRRQRRR (SEQ ID NO: 1).

16. The semiconductor nanocrystal conjugate of claim 13, wherein the cationic polymer has from 5 to 25 contiguous Lys and/or Arg residues.

17. A method of enhancing the transport of a semiconductor nanoparticle across a biological membrane comprising contacting a cell with the semiconductor nanoparticle complex of claim 1, under conditions that provide for the transport of the semiconductor nanoparticle across the biological membrane.

18. A method of enhancing the transport of a semiconductor nanocrystal across a cell membrane comprising contacting a cell with the semiconductor nanocrystal complex of claim 12, under conditions that provide for the transport of the semiconductor nanoparticle across the cell membrane.

19. A method of enhancing the transport of a semiconductor nanocrystal across a cell membrane comprising contacting a cell with the semiconductor nanocrystal complex of claim 14, under conditions that provide for the transport of the semiconductor nanoparticle across the cell membrane.

20. A method of enhancing the transport of a semiconductor nanocrystal across a cell membrane comprising contacting a cell with the semiconductor nanocrystal complex of claim 16, under conditions that provide for the transport of the semiconductor nanoparticle across the cell membrane.

21. The method of claim 18, wherein the cell is prokaryotic.

22. The method of claim 18, wherein the cell is eukaryotic.

23. The method of claim 22, wherein the cell is a mammalian cell selected from the group consisting of a human cell, a mouse cell, a rat cell, a bovine cell, and a hamster cell.

24. A method of distinguishably identifying a cell, comprising:

(a) providing a cell; and

(b) contacting the cell with a semiconductor nanoparticle complex according to claim 1 under conditions in which the semiconductor nanoparticle is transported across the cell membrane to provide a labeled cell, thereby identifying the cell.

25. A method of distinguishably identifying a cell, comprising:

(a) providing a cell; and

(b) contacting the cell with a semiconductor nanocrystal complex according to claim 12 under conditions in which the semiconductor nanocrystal is transported across the cell membrane to provide a labeled cell, thereby identifying the cell.

26. A method of distinguishably identifying a cell, comprising:

(a) providing a cell; and

(b) contacting the cell with a semiconductor nanocrystal complex according to claim 14 under conditions in which the semiconductor nanocrystal is transported across the cell membrane to provide a labeled cell, thereby identifying the cell.

27. A method of distinguishably identifying a cell, comprising:

(a) providing a cell; and

(b) contacting the cell with a semiconductor nanocrystal complex according to claim 16 under conditions in which the semiconductor nanocrystal is transported across the cell membrane to provide a labeled cell, thereby identifying the cell.

28. The method of claim 25, wherein the cell is prokaryotic.

29. The method of claim 25, wherein the cell is eukaryotic.

30. The method of claim 29, wherein the cell is a mammalian cell selected from the group consisting of a human cell, a mouse cell, a rat cell, a bovine cell, and a hamster cell.

31. A method of identifying a cell in a mixed population of cells, comprising:

(a) providing a first cell;

(b) contacting the cell with a semiconductor nanoparticle complex according to claim 1 under conditions in which the semiconductor nanoparticle is transported across the cell membrane to provide an encoded first cell;

(c) mixing the encoded first cell with a second cell distinct therefrom to form a mixed population of cells;

(d) culturing the mixed population of cells;

(e) exposing the cultured mixed population of cells to an excitation energy source; and

(f) detecting a semiconductor nanoparticle code to identify the encoded cell.

32. A method of identifying a cell in a mixed population of cells, comprising:

(a) providing a first cell;

(b) contacting the cell with a semiconductor nanocrystal complex according to claim 12 under conditions in which the semiconductor nanocrystal is transported across the cell membrane to provide an encoded first cell;

(c) mixing the encoded first cell with a second cell distinct therefrom to form a mixed population of cells;

(d) culturing the mixed population of cells;

(e) exposing the cultured mixed population of cells to an excitation energy source; and

(f) detecting a semiconductor nanocrystal code to identify the encoded cell.

33. A method of identifying a cell in a mixed population of cells, comprising:

(a) providing a first cell;

(b) contacting the cell with a semiconductor nanocrystal complex according to claim 14 under conditions in which the semiconductor nanocrystal is transported across the cell membrane to provide an encoded first cell;

(c) mixing the encoded first cell with a second cell distinct therefrom to form a mixed population of cells;

(d) culturing the mixed population of cells;

(e) exposing the cultured mixed population of cells to an excitation energy source; and

(f) detecting a semiconductor nanocrystal code to identify the encoded cell.

34. A method of identifying a cell in a mixed population of cells, comprising:

(a) providing a first cell;

(b) contacting the cell with a semiconductor nanocrystal complex according to claim 16 under conditions in which the semiconductor nanocrystal is transported across the cell membrane to provide an encoded first cell;

(c) mixing the encoded first cell with a second cell distinct therefrom to form a mixed population of cells;

(d) culturing the mixed population of cells;

(e) exposing the cultured mixed population of cells to an excitation energy source; and

(f) detecting a semiconductor nanocrystal code to identify the encoded cell.

35. The method of claim 32, wherein the cell is prokaryotic.

36. The method of claim 32, wherein the cell is eukaryotic.

37. The method of claim 36, wherein the cell is a mammalian cell selected from the group consisting of a human cell, a mouse cell, a rat cell, a bovine cell, and a hamster cell.

38. A kit comprising a semiconductor nanoparticle complex according to claim 1 and instructions for preparing encoded cells using the semiconductor nanoparticle complex.

39. A kit comprising a semiconductor nanocrystal complex according to claim 12 and instructions for preparing encoded cells using the semiconductor nanocrystal complex.

40. A kit comprising a semiconductor nanocrystal complex according to claim 14 and instructions for preparing encoded cells using the semiconductor nanocrystal complex.

41. A kit comprising a semiconductor nanocrystal complex according to claim 16 and instructions for preparing encoded cells using the semiconductor nanocrystal complex.